DUAL SNEAK CURRENT PROTECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention:

This invention relates generally to voltage and/or surge-current protector packages. More particularly, it relates to a voltage and/or surge-current protector and grounding bar arrangement which includes a two-piece interfitting housing of a unique construction for receiving a surge-current protector device and/or an over-voltage protector device, and a grounding bar adapted to be mounted upon a BIX connector block for connection to a ground contact associated with the over-voltage protector device.

2. Description of the Prior Art:

Heretofore, there has been known in the prior art of a device and structural arrangement which provides both over-current (surge-current) and over-voltage protection for use in conjunction with a telephone terminal block, conventionally referred to as an AT&T Style 110 Block. Such a voltage and/or current protector and grounding bar arrangement for the AT&T Style 110 Block is illustrated and described within U.S. Patent No. 5,341,269 which was issued to Gregory R. Hayward et al. and is assigned to the same assignee as that of the present invention. This '269 patent is hereby incorporated by reference in its entirety which discloses a two-piece interfitting

housing having an over-voltage protection device disposed therein and operatively connected to a ground contact. A strip-like grounding bar is configured so as to be able to be disposed within a longitudinally extending channel defined between two rows of laterally spaced terminals provided on the telephone terminal block. The grounding bar is provided with a longitudinally extending array of holes into which the ground contact of the two-piece housing is able to be disposed. A plurality of terminal/fuse contacts are also provided internally within the two-piece housing. A plug-in surge-current protection device, such as a fuse carrier, is operatively mounted upon the housing for connection to the terminal/fuse contacts. The terminal/fuse contacts are also interconnected to opposed terminals of the two rows of laterally spaced terminals of the telephone terminal block.

Further, there is also disclosed in the prior art U.S. Patent No. 5,555,153 issued to Hayward et al. and assigned to the same assignee as that of the present invention. The '153 patent was based upon a Continuation-In-Part application which was filed on parent application Serial No. 07/923,249, now the aforementioned U.S. Patent No. 5,341,269. This '153 patent is likewise hereby incorporated by reference in its entirety which discloses a voltage protector and grounding bar arrangement for use with a telephone terminal block having at least two rows of terminals which are spaced apart from each other so as to form an elongated channel therebetween. The voltage protector and grounding bar arrangement includes a two-interfitting housing for receiving or containing an over-voltage or surge-voltage

protection device therein, a ground contact, and a grounding bar adapted to be mounted upon the terminal block and to be connected to the ground contact. The grounding bar is disposed within the channel of the terminal block. Two plug-in carrier devices for mating with terminal contacts are mounted within the housing and are adapted to be connected to aligned terminals of the terminal block. The plug-in carriers may house fuses, PTC current-limiting devices, or bridging clips.

While the foregoing voltage and/or surge-current protector and grounding bar arrangements disclosed in the aforementioned '269 and '153 patents provided the necessary over-voltage and over-current protection required, it has been noted that these arrangements are especially designed to be used in conjunction with a particular or specific telephone terminal block, i.e., the AT&T Style 110 Block. Inasmuch as an alternative telephone terminal block is also commonly used within the telephone and other electronic applications, conventionally referred to as a BIX connector block which is manufactured and sold by NORDX/CDT (a subsidiary of Cable Design Technologies), it would be desirable to provide a new voltage and/or surge-current protector and grounding bar arrangement which can be used in conjunction with a BIX connector block.

It has also been noted that the prior art arrangements utilized separate, plug-in, surge-current carriers which are adapted to be received by the upper portion of the two-piece interfitting housing.

In order to simplify manufacture of the separate carriers and housings as well as to minimize assembly or labor costs, it would also be expedient to provide a housing of a unique construction which will accommodate an over-current device and/or over-voltage device with a single standardized or uniform housing in lieu of separate plug-in carriers mounted on a housing. Further, in the prior art arrangements a label designating the various ones of the 25-pair protectors is typically installed underneath the protectors and on the top surface of the grounding bar. Thus, when all of the 25-pair protectors are inserted or punched down into corresponding ones of the openings in the grounding bar the label will be hidden from view. Accordingly, it would be also desirable to provide a label strip which can be placed on top of the housings of the 25-pair protectors so that it can be visually seen without requiring prior removal of the protectors from the telephone terminal block.

SUMMARY OF THE INVENTION

Accordingly, it is a general object of the present invention to provide a new and improved voltage and/or surge-current protector and grounding bar arrangement for use in conjunction with a BIX connector block which is relatively simple and economical to manufacture and assemble.

It is an object of the present invention to provide a new and improved voltage and/or surge-current protector and grounding bar arrangement for a BIX connector block in which over-current protection and/or over-voltage protection is provided.

It is another object of the present invention to provide a new and improved voltage and/or surge-current protector and grounding bar arrangement which includes a housing of a unique construction which will accommodate an over-current device and/or over-voltage device with a single standardized housing.

It is still another object of the present invention to provide a new and improved voltage and/or surge-current protector and grounding bar arrangement which includes a label strip which can be placed on top of the housings of the 25-pair protectors so that it can be visually seen without requiring prior removal of the protectors from the telephone terminal block.

It is yet still another object of the present invention to provide a new and improved voltage and/or surge-current protector and grounding bar arrangement which includes a disconnect arrangement for allowing testing and line-servicing without removal of a voltage and/or surge-current protector from a telephone terminal block.

In a preferred embodiment of the present invention, there is provided a voltage and/or surge-current protector and grounding bar arrangement for use with a BIX connector block having two rows of

terminals which are laterally spaced apart with respect to each other so as to form a longitudinally extending channel therebetween. A grounding bar is disposed within the longitudinally extending channel defined between the two laterally spaced rows of terminals and includes a plurality of holes defined therein. Voltage and/or surge-current protector devices are disposed within a housing.

A plurality of tip/ring terminal contacts are also disposed within the housing for mating with opposed terminals of the BIX connector block, disposed upon opposite sides of the longitudinally extending channel, when the housing is mounted upon the BIX connector block. A ground contact is disposed within the housing for connection to the voltage and/or surge-current protector devices and to one of the plurality of holes defined within the grounding bar.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the present invention will become more fully apparent from the following detailed description when read in conjunction with the accompanying drawings with like reference numerals indicating corresponding parts throughout, wherein:

Figure 1 is a perspective view of a voltage and/or surge-current protector and grounding bar arrangement, constructed in accordance with the principles of the present invention;

Figure 2 is an enlarged, perspective view of a portion of the arrangement of Figure 1;

Figure 3 is a front, perspective view of the back half assembled with certain electrical components of the housing of Figure 1;

Figure 4 is a front, perspective view of the front half assembled with certain other electrical components of the housing of Figure 1;

Figure 5 is a top plan view, taken along the lines 5-5 of Figure 2, with the label strip removed;

Figure 6 is a front, perspective view, similar to Figure 3, but with the electrical components thereof assembled therein for use as a high speed protector assembly;

Figure 7 is a front, perspective view, similar to Figure 4, but showing certain other electrical components thereof assembled therein for use as a high speed protector assembly;

Figure 8 is a front, perspective view, similar to those of Figures 3 and 5, but showing the electrical components thereof assembled therein for use as a dual sneak-current protector;

Figure 9 is a top plan view of the housing of Figure 2, showing a test probe inserted into the housing but prior to breaking the disconnect contacts;

Figure 10 is a view similar to Figure 9, but showing the test probe inserted into the housing and breaking the disconnect contacts for allowing tests in two directions;

Figure 11 is a schematic circuit diagram of the protection circuitry contained within the housing of Figure 2 for use as a dual sneak-current protector in conjunction with the disconnect contacts;

Figure 12 is a schematic circuit diagram of the protection circuitry contained within the housing of Figure 2 for use as an over-voltage protector in conjunction with the disconnect contacts;

Figure 13 is a schematic circuit diagram of the protection circuitry contained within the housing of Figure 2 for use as a sneak-current and over-voltage protector in conjunction with the disconnect contacts;

Figure 14 is a schematic circuit diagram of the protection circuitry contained within the housing of Figure 2 for use as a high-speed sneak-current and over-voltage protector in conjunction with the disconnect contacts;

Figure 15 is a side view of the grounding bar forming a part of the present invention;

Figure 16 is a top plan view of the grounding bar of Figure 15, taken along the lines 16-16 of Figure 15;

Figure 17 is a cross-sectional view of a portion of the grounding bar of Figure 15, taken along the lines 17-17 of Figure 16;

Figure 18 is a front view of one of the tip/ring terminal contacts forming a part of the present invention;

Figure 19 is a side view of the terminal contact of Figure 18, taken along the lines 19-19 of Figure 18;

Figure 20 is a back view of the terminal contact of Figure 18;

Figure 21 is a side view of the ground contact forming a part of the present invention;

Figure 22 is a top view of the ground contact of Figure 21, taken along the lines 22-22 of Figure 21;

Figure 23 is an end view of the ground contact of Figure 21, taken along the lines 23-23 of Figure 21;

Figure 24 is an enlarged perspective view of the long disconnect terminal contact of Figure 3;

Figure 25 is an enlarged, perspective view of the short disconnect terminal contact of Figure 3;

Figure 26 is an enlarged, perspective view of the ring contact of Figure 3; and

Figure 27 is a perspective view of a second embodiment of the grounding bar forming a part of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in detail to the various views of the drawings and in particular to Figures 1 through 5, there is shown a voltage and/or surge-current protector and grounding arrangement constructed in accordance with the principles of the present invention which is designated generally by reference numeral **10**. The arrangement **10** is intended for physical and electrical association with a telephone terminal block, referred to as a BIX connector block, manufactured and sold by NORDX/CDT, which is commonly used within telephone circuitry and other electronic applications or systems. As can be seen from Figure 1, the terminal block or BIX connector block **12** comprises a pair of rows **14a, 14b** of terminals which are laterally spaced apart with respect to each other so as to form an elongated or longitudinally extending channel **16** therebetween.

Each of the respective rows **14a, 14b** is provided correspondingly with a plurality of longitudinally aligned terminals **18, 18'**. The terminals **18** in the row **14a** are disposed in alignment laterally with the opposed terminal **18'** in the row **14b**. Thus, each set of the

corresponding, laterally opposed or aligned terminals **18, 18'** define a terminal pair. As will be seen hereinbelow, the voltage and/or surge-current protector and grounding bar arrangement **10** of the present invention suitably interconnects with up to 25-terminal pairs (opposed terminals **18, 18'** in the rows **14a, 14b**) so as to protect sensitive telecommunication equipment from over-voltage and/or over-current conditions on incoming voice and data lines.

The voltage and/or surge-current protector and grounding bar arrangement **10** includes a plastic housing **20** made of a suitable material such as, for example, a fire-retardant polymer, and is comprised of two co-mating front and back halves **22, 24.** The two housing halves **22** and **24** are identical in their construction, which are assembled to each other and are ultimately sonically welded together. The housing **20** includes a lower portion **26,** a middle body portion **28,** and an upper test port portion **30.** The lower portion **26** is adapted to be plugged into the BIX connector block **12** during use. The upper test port portion **30** includes a pair of top recesses **32a, 32b** which are separated by an arch-shaped handle **34.** The top recess **32a** includes a slit **36** for receipt of a test probe for testing and line-servicing without removal of the housing **20** from the terminal block **12,** as will be explained more fully hereinafter. The top recess **32b** is adapted to receive slidably a 25-terminal pair identification label strip **37** to provide single terminal pair identification of up to 25-terminal pairs. The terminal pair identification on the label strip **37** is visible without removal of the housing **20** from the terminal block **12.**

The front and back halves **22** and **24** of the housing **20** are provided with confronting and interfitting sidewall members **38** and **40**, respectively, and are also provided with a recessed rear wall member **42**. The sidewall members **38**, **40** and rear wall member **42** are all formed integrally together so as to effectively define a cavity for receiving and enclosing a pair of voltage suppressors **44a**, **44b** such as sidactors or silicon avalanche suppressors similar to type 1.5KE and a pair of sneak-current fuses **46a**, **46b** or any number of different single or combined components in order to create other protector products using the same standardized housing **20**. A ground contact **48** is provided for reasons that will be apparent which is used in conjunction and interconnects with the voltage suppressors **44a**, **44b** and which extends through the lower portion **26** of a housing chamber **50** by means of suitable slot **52** formed therein. A strip-like grounding bar **54** is adapted to be disposed within the elongated or longitudinally extending channel **16** defined between the two rows **14a** and **14b** of the BIX connector block **12**. The grounding bar **54** is provided with a plurality of serially aligned openings **56** for receiving therein the spaced-apart prongs **74a**, **74b** (see Figures 21-23) of the corresponding ground contacts **48**.

The lower part of the middle body portion **28** in the front and back halves **22**, **24** are provided with four tip/ring terminal contacts **58a-58d**. The terminal contacts **58a-58d** shown in Figures 3 and 4 are all identical and one of them is depicted in full detail in Figures 18-20. The terminal contacts are preferably formed from phosphor-bronze strip metal are tin plated for solderability. Each of the

terminal contacts includes a flat body portion **60** which has mounting holes **62** formed therein for receiving mounting posts **64** disposed in the body portion **28**. At the upper edge of the body portion **60**, there is provided a vertical slit **66** for receiving therein a part of other components.

A ground contact **48** is stamped from non-ferrous sheet metal and is likewise made from a phosphor-bronze strip metal similar to the tip/ring terminal contacts **58a-58d**. The ground contact **48** is shown in Figure 3 and is illustrated in full detail in Figures 21-23. As can be seen from the latter Figures of the drawings, the ground contact **48** has a L-shaped configuration formed of a horizontally-extending leg portion **68** and a downwardly extending leg portion **70**. The leg portion **68** includes a pair of notches **72** for receiving terminal leads of electrical components. The leg portion **70** is formed by a pair of spaced-apart prongs **74a, 74b** which extend integrally from one end of the horizontal leg portion **68**. The ground contact **48** extends horizontally inside the chamber **50** in the lower portion **26** of the housing **20**.

The voltage suppressor **44a** such as, for example, the sidactor or silicon avalanche suppressor has terminal pin leads **76** and **78** extending therefrom. Similarly, the voltage suppressor **44b** has terminal pin leads **80** and **82** extending therefrom. The sneak-current fuse **46a** is provided with end leads **84, 86** and the sneak-current fuse **46b** is provided with end leads **88, 90**.

The lower part of the middle body portion **28** of the housing halves is formed with a pair of laterally spaced, vertical cavities **92** disposed on each side of the lower portion **26** of the housing halves. The four tip/ring terminal contacts **58a-58b** are received within the respective two vertical cavities **92** in the front and back housing halves **22, 24.** It will be noted that the mounting posts **64** formed in the respective housing halves extend through the corresponding mounting openings **62** in the tip/ring terminal contacts **48** so as to properly maintain the opposed terminal contacts of each of pair contacts separated from each other.

The chamber **50** in the lower portion **26** of the housing halves is defined by upper wall sections **94,** a lower wall **96,** and end wall portions **98** so as to retain the ground contact **48** therein against any movement. The lower wall **96** has slots **100** formed therein. It will be noted that the pair of spaced-apart prongs **74a, 74b** extend vertically downwardly through one of the slots **100** defined within the lower wall **96** of the chamber **50** so as to engage in an offset manner with the corresponding one of the plurality of aligned openings **56** in the grounding bar **54.** (See Figure 2).

The middle body portions **28** in the housing halves **22, 24** are also provided with a disconnection arrangement which is comprised of a long disconnect terminal contact **102,** a short disconnect terminal contact **104,** and a spring contact **106.** All of the contacts **102-106** shown in Figures 3 and 4 are illustrated in complete detail in the perspective views of Figures 24-26. In particular, in Figure 24 each of the long

disconnect tunnel contacts **102** (one of which is being depicted) is preferably formed from a suitable phosphor-bronze strip metal and is tin-plated for solderability and corrosion resistance. The terminal contact **102** includes a long, lower narrow leg **108**, a short upper narrow leg **110**, and an angled bight portion **112** joining the legs **108** and **110**. The lower leg **108** and the bight portion **112** forms with a number of slits **114** for receiving therein appropriate terminal leads of electrical components. It can be seen that the terminal contact **102** extends vertically through a vertical slot **116** defined by opposed supports **118** disposed in the middle body portion **28** of the housing halves **22, 24**. Further, the upper and lower ends of the terminal contact **102** abut against respective retaining lips **120, 121** so as to maintain the terminal contact **102** in place.

In Figure 25, each of the short disconnect terminal contacts **104** (one of which is being depicted) is made similar to the terminal contact **102** and is likewise preferably formed from a suitable phosphor-bronze strip metal and is tin-plated for solderability and corrosion resistance. The terminal contact **104** is defined by an arcuate-shaped leg having an upper end **122** disposed in contact engagement with the short upper narrow leg **110** of the terminal contact **102** and a lower end **124** extending through a vertical slot **126** defined by opposed supports **128** so as to be in contact engagement with one of the output tip/ring terminal contacts **58a** or **58c**.

In Figure 26, each of the spring contacts **106** (one of which is being depicted) is preferably formed of a bent wire made of a metallic

material or other suitable resilient material. The spring contact **106** has a generally L-shaped construction formed of a longer, vertical leg portion **130** and a shorter horizontal leg portion **132**. Normally, the shorter leg portion **132** is held in a horizontal slot **134** defined by opposed supports **136** which are disposed in the middle body portion **28** of the housing halves so that the longer leg portion **130** is urged contactly against the upper end **122** of the terminal contact **104**. As a result, the upper end **122** of the terminal contact **104** will be in contact engagement with the upper narrow leg portion **110** of the terminal contact **102**.

The grounding bar **54** is fabricated from a suitable non-ferrous metal strip, such as, for example, copper and is formed so as to have the configuration or structure partially depicted in Figures 1 and 2 and depicted in full detail in Figures 15-17. Specifically, the grounding bar **54** includes an elongated flat horizontal intermediate section **138** and a pair of terminal end sections **140** integrally connected to the opposite ends of the intermediate section **138**. The intermediate section **138** is provided with the plurality of serially-aligned offset holes or openings **56** for receiving therein the spaced-apart prongs **74a, 74b** of the ground contact **48**, as can best be seen from Figure 2. The grounding bar **54** is disposed within the channel **16** (Figure 1) defined between the two rows **14a** and **14b** so as to extend substantially throughout the length of the BIX connector block **12**.

With particular reference to Figure 17, the terminal end portion **140** has a vertical offset **142** which is especially designed to be

interposed or press fitted between protuberances **144** and **146** located at each end of the BIX connector block **12** and is integrally joined to the respective ends of the intermediate section **138**. Above and below the vertical offset **142**, there are provided respective rectangularly-shaped apertures **148**, **150** through which the corresponding protuberances **144**, **146** extend for fixedly securing the grounding bar **54** within the channel **16**. It will be noted that a horizontal top wall **152** is connected integrally to the upper end of the vertical offset **142**. The top wall **152** rests upon an end frame member **153** of the connector block **12** and extends outwardly therefrom.

A first angularly-disposed connecting flange **154** is joined integrally to the outer end of the top wall **152** and extends downwardly therefrom. The connecting flange **154** is provided with a central aperture **156**. A second angularly-disposed connecting flange **158** is disposed parallel to, but spaced apart from, the first angularly-disposed connecting flange **154**. The second flange **158** is also integrally connected to the lower end of the first flange **154** by means of a U-shaped connecting portion **160**. A central aperture **162** is provided within the second connecting flange **158** which is aligned with the central aperture **156** of the first flange **154**. A slot **163** is effectively defined between the first and second spaced apart flanges **154**, **158** and thus also between the aligned central apertures **156**, **162**.

A square nut **164** is disposed within the slot **163**, and a screw **166** is initially inserted through the aperture **162** of the second flange **158** so as to be threaded through the nut **164**. Then, the screw **166**

subsequently extends through the aperture **156** in the first flange **154** so as to captivate the square nut **164**. A common ground bus wire **168** may be readily coupled to the head of the screw **166** mountable at either terminal end section **140** of the grounding bar **54**.

As was previously pointed out, unlike the prior art which utilized separate plug-in type fuse carriers, the fuses **46a, 46b** of the present invention are mounted within the middle body portion **28** of the housing **20** in order to reduce manufacturing and assembly costs. Referring now back to Figures 3 and 4, it can be seen that the middle body portion **28** has a cavity defined therein for accommodating the pair of sneak-current fuses **46a, 46b**. Further, the handle member **34** is integrally formed upon the upper surface of the upper test port portion **30** of the housing **20** so as to enable a user to grasp the housing **20** during a handling or transportation mode or to facilitate the insertion into and removal from the aligned terminals **18, 18'** and the grounding bar **54** of the BIX connector block **12**.

For assembly, the four tip/ring terminal contacts **58a-58d**, ground contact **48**, voltage suppressors **44a, 44b**, sneak-current fuses **46a, 46b**, long disconnect terminal contacts **102**, short disconnect terminal contacts **104**, and spring contacts **106** are all positioned appropriately in the respective two halves **22, 24** of the housing **20**, as shown in Figures 3 and 4. Next, the electrical components are suitably soldered together so as to make the appropriate electrical connections as illustrated in the schematic circuit diagram of Figure 13. For example, the terminal pin leads **76** and **78** of the voltage suppressor

44a are connected by solder to the respective disconnect terminal contact **102** and the ground contact **48**. Similarly, the terminal pin leads **80** and **82** of the voltage suppressor **44b** are connected by solder to the respective ground contact **48** and the disconnect terminal contact **102b** via a jumper wire **83**. The sneak-current fuse **46a** has its terminal pin leads **84, 86** connected by solder to the respective disconnect terminal contact **102a** and to the input tip terminal contact **58b**. Also, the fuse **46b** has its terminal pin leads **88, 90** connected by solder to the respective disconnect terminal contact **102b** and the input ring terminal contact **58d**.

Then, the housing halves **22, 24** are brought together so as to sandwich all of the electrical components therebetween. Thereafter, a sonic welding process is used to fixedly secure the two halves of the housing **20** together. The prongs **74a, 74b** of the ground contact **48** extend externally and vertically from the lower portion **26** of the housing **20** and are inserted or press fitted into one of the openings **56** in the horizontal member **138** of the grounding bar **54** which is mounted in the BIX connector block **12**. Finally, the label strip **37** is installed within the recesses **32b** formed in the upper portion **30** of the housing **20**. In this manner, the voltage and/or sneak-current protector and grounding bar arrangement **10** of Figure 1 is thus formed and is illustrated in the schematic circuit diagram of Figure 13.

With respect to Figures 9 and 10 as well as to Figures 3 and 4, the operation of the disconnect arrangement of the present invention which allows for look-both-ways testing and line servicing without

removal of the protector housing **20** from the terminal block **12** will now be explained. In Figure 9, a conventional single-sided test probe **170** has been placed into the test port **36** but has not been engaged with the disconnect terminal contacts **102** and **104**. Accordingly, the short disconnect contact terminal **104** in Figures 3 and 4 will be in contact engagement with the long disconnect contact terminal **102** due to the force of the spring contact **106** being urged upon it. In Figure 10, the test probe **170** is inserted between the disconnect terminal contacts **102, 104** so as to break or disengage their contact engagement. The long disconnect terminal contact **102** of Figures 3 and 4 will become disengaged from the short disconnect terminal contact **104** due to the interaction of the test probe **170**. As a result, the connections between the tip/ring input (line side) and output (equipment side) terminals are disconnected which permits the testing on both the line side and on the equipment side.

With reference now being made to Figures 6 and 7, in those applications where the protector arrangement requires a high-speed, high-frequency operation, a diode bridge rectifier **43** has been added within the housing half **24a** of the housing. Except for this difference, the remaining components or elements disposed in the housing halves **22a, 24a** and their electrical interconnection are substantially identical to those of the housing **20** illustrated in Figures 3 and 4. It should be noted that in order to simplify manufacturing of the housing halves **22a, 24a** and to further minimize manufacturing cost the standardized or uniform housing halves **22, 24** of Figures 3 and 4 are used regardless of whether or not the housing

halves are required to accommodate the diode bridge rectifier **43**. Figure 14 is a schematic circuit diagram, similar to Figure 13, but illustrates the additional diode bridge rectifier **43** being connected electrically between the tip and ring connections.

With reference to Figure 8, it is sometimes desirable to provide only sneak-current or over-current protection without requiring the need of over-voltage protection to be provided within the same housing half **24b**. In this instance, the voltage suppressors **44a**, **44b** of Figure 3 are eliminated. It will also be noted that the ground contact **48** in the housing half **24b** is not required to be joined to any other component for connection to the grounding bar **48**. Figure 11 is a schematic circuit diagram, similar to Figure 13, but depicting only the sneak-current fuses **46a**, **46b**, the voltage suppressors being eliminated. It is also sometimes desirable to provide only over-voltage protection without requiring the need of over-current protection to be placed within the same housing **20**. Accordingly, Figure 12 is a schematic circuit diagram, similar to Figure 13, but illustrating only the voltage suppressors **44a**, **44b** with the fuses being eliminated.

In Figure 27, there is shown a perspective view of a second embodiment of a grounding bar **54a** which is substantially identical to the grounding bar **54** illustrated in Figures 15-17 except that a part of the elongated flat horizontal intermediate section **138a** is bent or folded downwardly so as to define a reinforcement rib **139**. The reinforcement rib **139** serves as a support element so as to prevent a

downward bending of the intermediate section **138a** during insertion of the housing **20** into one of the openings **56a** of the grounding bar **54a**.

From the foregoing detailed description, it can thus be seen that the present invention provides a voltage and/or surge-current protector and grounding bar arrangement for use with a BIX connector block having two rows of terminals which are laterally spaced apart with respect to each other so as to form a longitudinally extending channel therebetween. The arrangement includes a grounding bar disposed within the longitudinally extending channel defined between the two laterally spaced rows of terminals and has a plurality of holes defined therein. Voltage and/or surge-current protector devices are disposed within a housing. A plurality of tip/ring terminal contacts are also disposed within the housing for mating with opposed terminals of the BIX connector block, disposed upon opposite sides of the longitudinally extending channel, when the housing is mounted upon the BIX connector block. A ground contact is disposed also within the housing for connection to the voltage and/or surge current protector devices and to one of the plurality of holes defined within the grounding bar.

While there has been illustrated and described what is at present considered to be a preferred embodiment of the present invention, it will be understood by those skilled in the art that various changes and modifications may be made, and equivalents may be substituted for elements thereof without departing from the true scope of the invention. In addition, many modifications may be made to adapt a

particular situation or material to the teachings of the invention without departing from the central scope thereof. Therefore, it is intended that this invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out the invention, but that the invention will include all embodiments falling within the scope of the appended claims.